WHAT WE CLAIM IS:

1. A hydrogen-purification membrane, comprising a porous support substrate having a plurality of pores and a Pd alloy film joined to one surface of said porous support substrate, wherein:

each pore in said porous support substrate is configured to have a narrowest portion therein,

between a thickness T of said porous support substrate, an opening diameter D1 of each pore on a side joined to said Pd alloy film and an opening diameter D2 of the pore on an opposite side, there are relations represented by $1.0 \leqq D1/T \leqq 5.0$ and $1.0 \leqq D2/T \leqq 5.0$,

between the opening diameter D1 of the pore on the side joined to said Pd alloy film, the opening diameter D2 of the pore on the opposite side and an opening diameter D3 of the narrowest portion of the pore, there are relations represented by $D3/D1 < 0.8$, $D3/D2 < 0.9$ and $D3 < 250$ μm, and

a total opening area of the pores on the side joined to said Pd alloy film accounts for 20 to 80% of an area of said porous support substrate.

2. A hydrogen-purification membrane according to claim 1, wherein said porous support substrate has a thickness ranging from 20 to 500 μm, and said Pd alloy film has a thickness ranging from 0.5 to 30 μm.

3. A hydrogen-purification membrane, comprising a porous support substrate having a plurality of pores and a Pd alloy film joined to one surface of said porous support substrate, wherein:

between a thickness T of said porous support substrate, an opening diameter D1 of each pore on a side joined to said Pd alloy film and an opening diameter D2 of

the pore on an opposite side, there are relations represented by $1.5 \leqq D1/T \leqq 5.0$ and $0.2 \leqq D2/D1 \leqq 0.8$, and

a total opening area of the pores on the side joined to said Pd alloy film accounts for 30 to 90% of an area of said porous support substrate.

4. A hydrogen-purification membrane according to claim 3, wherein said porous support substrate has a thickness ranging from 20 to 500 μm, and said Pd alloy film has a thickness ranging from 0.5 to 30 μm.

5. A hydrogen-purification membrane fabrication process, comprising:

a resist-formation step of forming a resist pattern having a plurality of openings on a front surface of an electrically conductive support substrate, and forming on a back surface of said support substrate a resist pattern having a plurality of openings in alignment with the openings in the first resist pattern,

an etching step of etching said support substrate from front and back sides thereof using said resist patterns as masks to make a porous support substrate having a plurality of pores, wherein each pore has a narrowest portion therein; $1.0 \leqq D1/T \leqq 5.0$ and $1.0 \leqq D2/T \leqq 5.0$ are satisfied with respect to relations of an opening diameter D1 of the pore on a front surface side and an opening diameter D2 of the pore on a back surface side to a thickness T of said support substrate; $D3/D1 < 0.8$, $D3/D2 < 0.9$ and $D3 < 250$ μm are satisfied with respect to relations of an opening diameter D3 of said narrowest portion to said opening diameters D1 and D2; and a total area of the openings on the front surface side accounts for 20 to 80% of an area of said porous support substrate,

a filling step of applying an insulating film onto

the back surface side of said support substrate, and forming a plating layer on said porous support substrate from the front surface side thereof by electrolytic plating in such a way as to fill in said pores,

a film-formation step of removing said insulating film, polishing said plating layer in such a way as to expose the front surface of said porous support substrate, and forming a Pd alloy film on the thus polished surface side by plating, and

a removal step of removing said plating layer and said electrically conductive undercoat layer from the back surface side of said porous support substrate by means of selective etching.

6. A hydrogen-purification membrane fabrication process according to claim 5, wherein at said film-formation step, the Pd alloy film is formed by electrolytic plating.

7. A hydrogen-purification membrane fabrication process according to claim 5, wherein at said film-formation step, thin films of individual components that form the Pd alloy film are first stacked by plating, and heat treatment is then applied to a stack to form the Pd alloy film by component diffusion.

8. A hydrogen-purification membrane fabrication process according to claim 5, wherein at said film-formation step, a strike plating layer is formed on said polished surface side, and the Pd alloy film is then formed, while said strike plating layer is removed by selective etching at said removal step.

9. A hydrogen-purification membrane fabrication process according to claim 5, wherein at said film-formation step, a strike plating layer is formed on said

polished surface side, and the Pd alloy film is then formed, while heat treatment is applied to said strike plating layer for component diffusion into the Pd alloy film.

10. A hydrogen-purification membrane fabrication process according to claim 5, wherein at said film-formation step, a diffusion-preventive layer is formed on said polished surface side by electrolytic plating or electroless plating, and the Pd alloy film is then formed, while said diffusion-preventive layer is removed by selective etching at said removal step.

11. A hydrogen-purification membrane fabrication process, comprising:

a resist-formation step of forming a resist pattern having a plurality of openings on a front surface of an electrically conductive support substrate, and forming on a back surface of said support substrate a resist pattern having a plurality of smaller openings in alignment with the openings in the first resist pattern and with a smaller area than that of the first openings or having no such smaller openings,

an etching step of etching said support substrate from the front and back surfaces or the front surface thereof using said resist patterns as masks to make a porous support substrate having a plurality of pores wherein $1.5 \leqq D1/T \leqq 5.0$ and $0.2 \leqq D2/D1 \leqq 0.8$ are satisfied with respect to relations of an opening diameter D1 on the front surface side and an opening diameter D2 on the back surface side to a thickness T of said support substrate; and a total area of the openings on the front surface side accounts for 20 to 80% of an area of said porous support substrate,

a filling step of applying an insulating film onto the back surface side of said support substrate, and forming a plating layer on said porous support substrate from the front surface side thereof by electrolytic plating in such a way as to fill in said pores,

a film-formation step of removing said insulating film, polishing said plating layer in such a way as to expose the front surface of said porous support substrate, and forming a Pd alloy film on the thus polished surface side by plating, and

a removal step of removing said plating layer and said electrically conductive undercoat layer from the back surface side of said porous support substrate by means of selective etching.

12. A hydrogen-purification membrane fabrication process according to claim 11, wherein at said film-formation step, the Pd alloy film is formed by electrolytic plating.

13. A hydrogen-purification membrane fabrication process according to claim 11, wherein at said film-formation step, thin films of individual components that form the Pd alloy film are first stacked by plating, and heat treatment is then applied to a stack to form the Pd alloy film by component diffusion.

14. A hydrogen-purification membrane fabrication process according to claim 11, wherein at said film-formation step, a strike plating layer is formed on said polished surface side, and the Pd alloy film is then formed, while said strike plating layer is removed by selective etching at said removal step.

15. A hydrogen-purification membrane fabrication process according to claim 11, wherein at said film-

formation step, a strike plating layer is formed on said polished surface side, and the Pd alloy film is then formed, while heat treatment is applied to said strike plating layer for component diffusion into the Pd alloy film.

16. A hydrogen-purification membrane fabrication process according to claim 11, wherein at said film-formation step, a diffusion-preventive layer is formed on said polished surface side by electrolytic plating or electroless plating, and the Pd alloy film is then formed, while said diffusion-preventive layer is removed by selective etching at said removal step.
